Analysis of territorial and age
features of morbidity and availability of medical care

Análisis de las características territoriales y de edad de la morbilidad y la disponibilidad de atención médica

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Abstract

The growing incidence and prevalence of chronic diseases and the negative demographic situation in the Russian Federation determine the relevance of an in-depth study of the processes that cause negative trends in regional morbidity, the development of organizational and methodological measures and technologies to improve the quality of health care and increase the average life expectancy. The objective is to study the influence of the age factor and the availability of medical care on the changes in the morbidity of the urban population of the Republic of Tatarstan. We applied modern research methods such as bibliographic (content analysis), comparative, analytical, descriptive statistics, correlation analysis, time series analysis, and assessing the significance of differences with p <0.05. The research material was data of Rosstat for 2006–2018. An absolute increase in the population in densely populated areas was established due to an increase in the number of children 0-14 years old and older persons. The availability of outpatient facilities and doctors and the increase in the number of primary healthcare cases contribute to an increase in the prevalence and incidence. A decrease in the proportion of people of working age leads to a dynamic growth in the proportion of people over 65 in the region.

Keywords: morbidity, incidence, age groups, territorial settlement systems, timeseries, age, availability.

Resumen

La creciente incidencia y prevalencia de enfermedades crónicas y la situación demográfica negativa en la Federación de Rusia determinan la relevancia de un estudio en profundidad de los procesos que provocan tendencias negativas en la morbilidad regional, el desarrollo de medidas organizativas y metodológicas y tecnologías para mejorar la calidad de la asistencia sanitaria y aumentar la esperanza de vida media. El objetivo es estudiar la influencia del factor edad y la disponibilidad de atención médica sobre los cambios en la morbilidad de la población urbana de la República de Tartaristán. Se aplicaron métodos de investigación modernos como bibliográfico (análisis de contenido), estadística comparativa, analítica, descriptiva, análisis de correlación, análisis de series de tiempo y evaluación de la significancia de diferencias con p <0.05.

El material de investigación fue información de Rosstat para 2006-2018. Se estableció un aumento absoluto de la población en áreas densamente pobladas debido a un aumento en el número de niños de 0 a 14 años y personas mayores. La disponibilidad de servicios para pacientes ambulatorios y médicos y el aumento del número de casos de atención primaria de salud están contribuyendo a un aumento de la prevalencia y la incidencia. Una disminución en la proporción de personas en edad de trabajar conduce a un aumento dinámico en la proporción de personas mayores de 65 años en la región, lo que contribuye a una disminución de la incidencia y la prevalencia.

Palabras clave: morbilidad, incidencia, grupos de edad, sistemas de asentamiento territorial, series temporales, edad, disponibilidad.

Introduction

The general morbidity of the population is growing together with the deterioration of the population's health and the inadequate efforts of the health care system in identifying and providing quality medical care to the population[1,2]. The ongoing processes of aging of the population against the background of a decrease in the provision of medical care require new approaches to the provision of primary health care to the people considering the territorial settlement of the population[3,4].

Objective: to assess changes in the overall morbidity of the population concerning age features, provision of medical care, and territorial settlement.

Methods

Research materials: official statistics on the overall morbidity in 4 municipalities with the largest population, which provided 67% of the gross regional product in the Republic of Tatarstan for 2006-2018[5,6]. The choice of the Republic of Tatarstan is since over the past 20 years; it has been included in the risk group for incidence among the adult population in the Russian Federation. About 80% of the diseases diagnosed over the past ten years are 13 main classes of diseases, among which respiratory diseases are the leading ones[7,8]. The study was conducted in the urbanized regions of the Republic of Tatarstan - Kazan, Naberezhnye Chelny, Zelenodolsky, Nizhnekamsky, and Almetyevsky districts with an administrative center in cities with a population of 200,000 or more. We have studied the changes in the population size within the age groups of 0-14, 15-17, 18-64, and over 65 years and the availability of primary health care[9,10]. The research methods were bibliographic (content analysis), comparative, analytical, descriptive statistics, correlation, and time series analysis. Calculations and graphical data analysis were performed in Microsoft Excel. The significance of differences was assessed at $p < 0.05$.

Results and Discussion

The availability of outpatient clinics and doctors, visits per inhabitant per year, incidence, and prevalence per territory have decreased over time. The age factor caused both a decrease and an increase in visits for both newly diagnosed and existing diseases. Provision with resources contributed to both a decrease and increase in overall morbidity. Thus, the availability of medical care, the visits made, and the age factor manifested themselves over time in four administrative and territorial entities with different trends and patterns. Consequently, the decrease in morbidity of the population, considering the territorial system of settlement, causes the need to develop innovative approaches for providing primary health care to the people.

The state trend of improving the negative demographic situation in the country, increasing life expectancy up to 78 years and increasing healthy life expectancy up to 67 years challenge society and healthcare to reduce the incidence of the population by improving preventive measures and rising commitment to maintaining a healthy lifestyle and modifying risk factors and improving both the detection of diseases in the population through modern technologies and organizational and methodological processes and the quality and safety of medical care.

The overall morbidity of the population in the Russian Federation has been reported to increase steadily[7]. The geography and age of the population are the factors of differences in the indicators of the general morbidity of the population[8]. The increase in morbidity in most regions of the country is due to the growth of non-contagious diseases by main classes, mainly due to circulatory, respiratory, and oncological diseases[9]. The review of scientific literature revealed differences in trends and rates of change in incidence and prevalence of diseases[10]. The increase in morbidity by main classes of diseases has been scientifically proven to be explained by the deterioration in the population's health status against the background of the influence of environmental factors and the progressive aging of the people.

Studies show that the higher the availability of medical care, the expertise of medical personnel, and diagnostic equipment is, the more diseases are diagnosed in patients who first applied to healthcare facilities. Consequently, the incidence rate and trends in its dynamics serve as criteria for assessing the quality of doctors, medical organizations, and the health care system in general[11,12].

Considering the sustainability of the continued growth in morbidity and aging of the population, an in-depth study of the processes and relationships of the external environment, age factors, and the level of availability of primary health care at the regional level is relevant.

The article presents the results of a study of the influence of the age factor and the availability of medical care on the changes in the incidence of the population in the urbanized regions of the Republic of Tatarstan.

The study found an increase in the share of those living in Kazan, Naberezhnye Chelny, and Zelenodolsky, Nizhnekamsky, and Almetyevsk districts in the structure of the population of the Republic of Tatarstan from 59.5% in 2006 to 62.2% in 2018[12]. That is, the areas selected for the study are densely populated. During the study period, the increase in the population in the urbanized regions of Tatarstan was due to the increase in the share of the child population aged 0-14 years and the adult population from 8.8% to 11.6% and from 47.8% to 48.9%, respectively. The increase in the adult population was due to people over 65 - from 10.7% to 14.8%, while the adolescent population and people of working age decreased from 2.9% to 1.7% and from 39, 2% to 35.2%, respectively[13,14]. The heterogeneous age of the population affects the dynamics of morbidity and the incidence of the main classes of diseases in the region concerning the availability of primary health care, doctors, and the trends of visits of the relevant population to outpatient facilities.

During the study period, more than 60% was the urban population of the Republic of Tatarstan, tending to increase by 2018[15,16]. The average dynamics of population growth over 13 years was 6.36%, with the maximum and minimum increase in

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the number of residents in Kazan by 11.8% and in Zelenodolsky district 3.4%, respectively[17,18]. Population trends by age groups are similar across territories. They are characterized by an increase in the number of children of 0-14 years old and people over 65, with the most significant changes in Kazan and Naberezhnye Chelny[4,19]. All selected districts of the Republic had a decrease in the adolescent population of 15-17 years old and people of working, with maximum losses in Naberezhnye Chelny[3,20].

The availability of medical care was investigated in terms of the availability of outpatient facilities (OPF) per 10,000 population, the availability of doctors per 10,000 population, and the number of visits per inhabitant per year.

The study found a decrease in the availability of OPF in most of the selected municipalities in 2006-2018: in Kazan by 3.7%, in Naberezhnye Chelny by 2.5%, in the Nizhnekamsky district by 16.4% and in the Almetyevsky district by 6.5%. In the Zelenodolsky district, otherwise, the availability of OPF increased by 5.6% [9-11].

The availability of doctors in 2018 did not reach the level of 2006 in any of the selected districts, with a decrease in Kazan by 33.9%, in the Almetyevsky district by 33.6%, in Naberezhnye Chelny by 28.1%, in the Nizhnekamsky district by 20.3%, with the slightest decline in Zelenodolsk region - by 8.2% [13,17].

Accordingly, the number of visits for primary health care per inhabitant per year decreased by 22.8%, 13.5%, 12.4%, 16.8%, and 23.9%, respectively[2,19].

The median of OPF availability in Kazan was 165.1, in Naberezhnye Chelny - 176.4, in Zelenodolsky district - 197.5, in Nizhnekamsky district - 181.9 and in Almetyevsky district - 206.1. Half of the lower to the top quartile values included 127.2-173.4, 159.3-183.2, 194.4-202.2, 172.0-203.3, and 175.1-209.7 in the selected municipalities per 10,000 population, respectively[15,17].

The median of the availability of doctors in Kazan was 28.9, in Naberezhnye Chelny - 21.8, in Zelenodolsky district - 21.9, in Nizhnekamsky district - 23.2 and in Almetyevsky district - 22.3. Half of the lower to the top quartile values included 25.5-31.4, 21.3-26.3, 21.2-22.3, 22.6-25.0, and 15.5-23.3 in the selected municipalities per 10,000 population, respectively[1,3].

The median of visits per person per year in Kazan was 10.3, in Naberezhnye Chelny - 9.2, in Zelenodolsky district - 7.0, in Nizhnekamsky district - 7.9 and in Almetyevsky district - 6.9. Half of the lower to the top quartile values included 9.9-10.9, 8.5-9.4, 7.0-7.5, 7.6-8.6, and 6.4-7.1, respectively[13-15].

Evaluation of the significance of differences in the availability of OPF revealed statistically significant differences (p <0.032 - 0.000015) between all the considered territorial entities. The exception was statistically insignificant differences between Zelenodolsky and Nizhnekamsky districts (p=0.0789), between Zelenodolsky and Almetyevsky districts (p=0.882), and between Nizhnekamsky and Almetyevsky districts (p=0.741).

Evaluation of the significance of differences in staff shortage revealed statistically significant differences (p <0.049 - 0.000006) between all the considered territorial entities. The exception was statistically insignificant differences between Naberezhnye Chelny and Zelenodolsky district (p=0.138) and Naberezhnye Chelny and Nizhnekamsky district (p=0.452).

Evaluation of the significance of differences in the number of visits per person per year revealed statistically significant differences (p <0.041) between all the considered territorial entities. The exception was statistically insignificant differences between Zelenodolsky and Nizhnekamsky districts (p=0.0796), between Zelenodolsky and Almetyevsky districts (p=0.190).

The availability of outpatient facilities and doctors in Kazan strongly correlate with each other - r = 0.715, with a significance at of 0.006; a similar situation was in Naberezhnye Chelny - r = 0.757, with a significance at p = 0.003 and in the Nizhnekamsk region - r = 0.897, with a significance at p = 0.0001.

The number of visits per person per year in Kazan also correlates strongly with the availability of outpatient healthcare professionals, r = 0.732, with a significance at p = 0.004 and the availability of outpatient facilities, r = 0.751, with a significance at p= 0.003.

In Almetyevsky district, the availability of outpatient clinics strongly correlates with the availability of doctors (r = 0.831, p = 0.0001), with the number of visits per person per year (r = 0.715, p = 0.006). In turn, the availability of doctors and the number of visits per person per year strongly correlate with each other (r = 0.681, p = 0.010).

Zelenodolsky district showed no statistically significant correlations between the studied indicators.

The availability of doctors and the share of working-age people are in direct statistically significant correlation in Kazan, Naberezhnye Chelny, and Nizhnekamsky and Almetyevsky districts.

The availability of outpatient facilities and the number of visits of working-age people for primary health care are in direct statistically significant correlation in Kazan, Naberezhnye Chelny, and Almetyevsky districts.

Our studies of the influence of the availability of medical care on the rate of visits for newly emerging and chronic diseases showed that in 2006-2018, the incidence of the urban population of the Republic of Tatarstan decreased, including in Kazan - by 7.9% (from 1048.6 to 965.4 per 1000 average annual population), in Naberezhnye Chelny - by 4.6% (from 876.1 to 836.0), Zelenodolsky district - by 15.5% (from 947.7 to 800.6), Nizhnekamsky district - by 9.5% (from 953.3 to 862.3), and Almetyevsky district - by 20.3% (from 712.5 to 568.0)[7,20].

The study established the uneven trend in the number of people seeking primary health care for newly emerging diseases in the context of the territories of the Republic of Tatarstan: an increase in the number of requests was noted in Kazan in 2009, 2012, 2014, 2017 and 2018, Naberezhnye Chelny - in 2007, 2009, 2012, 2013, 2014 and 2017, Zelenodolsky district

- in 2009, 2011, 2015 and 2017, Nizhnekamsky district - 2007, 2008, 2010, 2012, 2014 and 2016, Almetyevsky district - in 2008, 2009, 2015 and 2017[10,11].

On average, we revealed a decrease in the number of first visits per 1000 population by 83.2 in Kazan, by 40.1 in Naberezhnye Chelny, by 147.1 in Zelenodolsky district, by 91.0 in Nizhnekamsky district, and by 144.5 in Almetyevsky district[6,15].

Over 13 years, the prevalence in Kazan decreased by 10.2% (from 2065.8 to 1855.5 per 1000 average annual population), in Zelenodolsky district - by 14.3% (from 1840.5 to 1576.9) and in Almetyevsky district - by 13.5% (from 1345.5 to 1164.3). At the same time, there was an increase in prevalence in Naberezhnye Chelny by 5.3%, from 1615.7 to 1702.0, and no changes were observed in Nizhnekamsky district (from 1652.9 to 1651.0 per 1000 average annual population)[15,17].

The growing number of visits to OPF for chronic diseases was noted in Kazan in 2007, 2009, 2014, and 2018, Zelenodolsky district in 2007, 2009, 2011, 2013, and 2015, Almetyevsky district in 2007, 2008, 2009, 2015, 2017, and 2018, and Nizhnekamsky district in 2007, 2008, 2013, 2014 and 2016. At the same time, this trend in Naberezhnye Chelny alternated with the decline in 2011, 2015, 2016, and 2018[5-8].

We found a decrease in the number of visits for chronic diseases over time in Kazan by 210.3, Zelenodolsky district – by 263.6, Almetyevsky district – by 181.2, and the most significant increase Naberezhnye Chelny by 86.3 and in Nizhnekamsky district by 1.9 per 1000 population[9,11].

Evaluating the significance of differences in overall morbidity revealed statistically significant differences ($p < 0.0691$) between all the considered territorial entities.

The exception was statistically insignificant differences in incidence between Naberezhnye Chelny and Zelenodolsky district ($p = 0.0901$), between Naberezhnye Chelny and Nizhnekamsky district ($p = 0.0653$), and in prevalence between Naberezhnye Chelny and Zelenodolsky district ($p = 0.2968$).

Conclusion

Overall, the primary objective of the study was to analyze the impact of the age factor and the availability of medical care on the changes in the morbidity of the urban population of the Republic of Tatarstan. To meet that aim, the official statistics on the overall morbidity in 4 municipalities in the Republic of Tatarstan are investigated. Based on the results obtained it can be concluded that:

1. The higher the incidence in the region is, the higher the prevalence of diseases is.

2. The availability of doctors is statistically significant for incidence, while the availability of doctors, outpatient facilities and their visiting is statistically significant for prevalence.

3. The age factor is more significant for prevalence than incidence.

4. An increase in the working-age population and a decrease in the population over 65 cause an increase in the number of visits to outpatient facilities.

5. A direct and inverse correlation between age and medical care availability is characteristic of the working-age and older working age, respectively.

The availability of medical care visits outpatient facilities and the age factor had similar trends in five administrative-territorial entities with the maximum population of the Republic of Tatarstan but with different trends and patterns.

A non-uniform formation of prevalence, multidirectional in strength, direction, and the effect of medical care proves the need for detailed identification of priorities for appropriate management practices.

The objectivity of research and decision-making at the regional level in project activities seems to be justified. Regional territorial entities can serve as the basis for studying an extensive database for forming neural networks.

References

1. Dunger DB, Ahmed ML, Ong KK. Effects of obesity on growth and puberty. Best Practice & Research Clinical Endocrinology & Metabolism. 2005 Sep 1;19(3):375-90.

2. Hughes MM, Groenewold MR, Lessem SE, Xu K, Ussery EN, Wiegand RE, Qin X, Do T, Thomas D, Tsai S, Davidson A. Update: characteristics of health care personnel with COVID-19—United States, February 12–July 16, 2020. Morbidity and Mortality Weekly Report. 2020 Sep 25;69(38):1364.

3. Caze AM, Champion FP, Champion-Daviller MN. Approche du marketing hospitalier par les cadres paramédicaux. Techniques hospitalières médico-sociales et sanitaires. 1989;44(521):42-3.

4. Fan J, Liu Z, Mao X, Tong X, Zhang T, Suo C, Chen X. Global trends in the incidence and mortality of esophageal cancer from 1990 to 2017. Cancer medicine. 2020 Sep;9(18):6875-87.

5. Donabedian A. The seven pillars of quality. Archives of pathology & laboratory medicine. 1990 Nov 1;114(11):1115-8.

6. Kim L, Whitaker M, O'Halloran A, Kambhampati A, Chai SJ, Reingold A, Armistead I, Kawasaki B, Meek J, Yousey-Hindes K, Anderson EJ. Hospitalization rates and characteristics of children aged< 18 years hospitalized with laboratory-confirmed COVID-19—COVID-NET, 14 States, March 1–July 25, 2020. Morbidity and Mortality Weekly Report. 2020 Aug 14;69(32):1081.

7. Gilmour H, Ramage-Morin PL. Social isolation and mortality among

Canadian seniors. Health Reports. 2020 Jun 1;31(3):27-38.

8. Bragazzi NL, Zhong W, Shu J, Abu Much A, Lotan D, Grupper A, Younis A, Dai H. Burden of heart failure and underlying causes in 195 countries and territories from 1990 to 2017. European Journal of Preventive Cardiology. 2021 Feb 12.

9. Jiang Y, Lu H, Man Q, Liu Z, Wang L, Wang Y, Suo C, Zhang T, Jin L, Dong Q, Cui M. Stroke burden and mortality attributable to ambient fine particulate matter pollution in 195 countries and territories and trend analysis from 1990 to 2017. Environmental research. 2020 May 1;184:109327.

10. McClung N, Chamberland M, Kinlaw K, Matthew DB, Wallace M, Bell BP, Lee GM, Talbot HK, Romero JR, Oliver SE, Dooling K. The Advisory Committee on Immunization Practices' ethical principles for allocating initial supplies of COVID-19 vaccine—United States, 2020. Morbidity and mortality weekly report. 2020 Nov 27;69(47):1782.

11. James SL, Lucchesi LR, Bisignano C, Castle CD, Dingels ZV, Fox JT, Hamilton EB, Liu Z, McCracken D, Nixon MR, Sylte DO. Morbidity and mortality from road injuries: results from the Global Burden of Disease Study 2017. Injury prevention. 2020 Oct 1;26(Suppl 2):i46-56.

12. Covid CD, Team R, COVID C, Team R, COVID C, Team R, Burrer SL, de Perio MA, Hughes MM, Kuhar DT, Luckhaupt SE. Characteristics of health care personnel with COVID-19—United States, February 12–April 9, 2020. Morbidity and Mortality Weekly Report. 2020 Apr 17;69(15):477.

13. Shchepin VO, Shishkin EV. The analysis of mortality of population of able-bodied age because of external causes. Problemy sotsial'noi gigieny, zdravookhraneniia i istorii meditsiny. 2019 May 1;27(3):222-6.

14. Komilova NK, Mukhammedova NJ, Tojiyeva ZN, Nazarov MI, Egamberdiyeva UT. Territorial definitions of population mortality in Uzbekistan. Astra Salvensis. 2019;1:619-40.

15. Samarina VP, Skufina TP, Samarin AV. Russia's north regions as frontier territories: demographic indicators and management features.

16. Kalachikova ON, Gruzdeva MA. Social vulnerability of families with children in modern Russia. Economic and social changes: facts, trends, forecast. 2019;12(2):147-60.

17. Zambrano AM, Córdova MV, Hidrobo AM, Pico DP, Yamunaque YT, Uzhca BS, Cantos GY, Cardona DA. Implicaciones de lacuarentena por COVID-19 en la regulación del metabolismo de la glucosa. Diabetes Internacional. 2020;12(1):1-5.

18. Shiguango NS, Carrillo AO, Reinoso SM, Sevilla LP, Yamunaque YT, Daqui JY, Naula PT, Carrillo CT. Ansiedad y depresión en pacientes diabéticos durante la pandemia de COVID-19. Diabetes Internacional. 2020;12(1):17-21.

19. Abdulbaqi MR, Kassab HJ, Abdulelah FM. Preparation and evaluation of zinc oxide (ZnO) metal nanoparticles carriers for azilsartan. Archivos Venezolanos de Farmacologia y Terapéutica. 2021;40(4):353-60.

20. Tatyana S, Raisovna IV. Efficacy and safety of the indirect anticoagulant warfarin in its dosage based on the results of pharmacogenetic testing. Archivos Venezolanos de Farmacologia y Terapéutica. 2021;40(4):451-4.